COMPREHENSIVE
DICTIONARY
OF
ELECTRICAL
ENGINEERING

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x). Filtering is performed to enhance significant features of an image or to remove nonsignificant ones or noise.

filtered backprojection   an algorithm for image reconstruction from projections. In the filtering part of the algorithm, the projections are measured, their Fourier transforms computed, and the transforms are multiplied (filtered) by a weighting function. In the backprojection part, the inverse Fourier transforms of the weighted projections are computed and summed to yield the reconstructed image. Filtered backprojection is the reconstruction algorithm currently used by almost all commercial computed tomography scanners. *See also* Fourier transform, image reconstruction, projection, radon transform, reconstruction, tomography.

filtering   an estimation procedure in which the present value of the state vector (see the definition) is estimated based on the data available up to the present time.

fin efficiency   a thermal characteristic of an extended surface that relates the heat transfer ability of the additional area to that of the base area.

final test   electrical test performed after assembly to separate "good" devices from "bad."

finesse   measure of the quality of a Fabry-Perot interferometer; free spectral range divided by linewidth (full width at half maximum).

finger stick   an insulated stick like a hot-stick used to actuate a disconnect-switch atop a pole.

finite difference method   a numerical technique for solving a differential equation wherein the differential equation is replaced by a finite difference equation that relates the value of the solution at a point to the values at neighboring points.

finite difference time domain (FDTD)   a numerical technique for the solution of electromagnetic wave problems that involves the mapping of the Maxwell equations onto a finite difference mesh and then following the time evolution of an initial value problem. This technique is widely used to investigate the performance of a complex RF structures.

finite differences   a method used to numerically solve partial differential equations by replacing the derivatives with finite increments.

finite element   a numerical technique for the solution of boundary value problems that involves the replacement of the set of differential equations describing the problem under consideration with a corresponding set of integral equations. The area or volume of the problem is then subdivided with simple shapes such as triangles and an approximation to the desired solution with free parameters is written for each subregion and the resulting set of equations is minimized to find the final solution. This approach is useful for solving a variety of problems on complex geometries.

finite field   a finite set of elements and two operations, usually addition and multiplication, that satisfy a number of specific algebraic properties. In honor of the pioneering work by Evariste Galois, finite fields are often called Galois fields and denoted $GF(q)$, where q is the number of elements in the field. Finite fields exist for all q which are prime or the power of a prime.

finite state machine (FSM)   a mathematical model that is defined in discrete time and has a finite number of possible states it can reside in. At each time instance, an input, x, is accepted and an output, y, and a transition from the current state, S_c, to a new state, S_n, are generated based on separate functions of the input and the current state. A finite state machine can be uniquely defined by a set of possible states, S,

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finite state VQ (FSVQ)

an output function, $y = f(x, S_c)$, and a transition function, $S_n = g(x, S_c)$. An FSM describes many different concepts in communications such as convolutional coding/decoding, CPM modulation, ISI channels, CDMA transmission, shift-register sequence generation, data transmission and computer protocols. Also known as finite state automata (FSA), state machine.

finite state VQ (FSVQ) a vector quantizer with memory. FSVQ form a subset of the general class of recursive vector quantization. The next state is determined by the current state S_n together with the previous channel symbol u_n by some mapping function.

$$S_{n+1} = f(u_n, S_n), n = 0, 1, \ldots$$

This also obeys the minimum distortion property

$$\alpha(\mathbf{x}, s) = \overset{-1}{\min} \, d(\mathbf{x}, \beta(u, s))$$

with a finite state $S = [\alpha_1, \alpha_2, \ldots, \alpha_k$, such that the state S_n can only take on values in S. The states can be called by names in generality.

finite wordlength effect any perturbation of a digital filter output due to the use of finite precision arithmetic in implementing the filter calculations. Also called quantization effects.

FIR *See* far-infrared.

firing angle time in electrical degrees from the instant the valve voltage is positive to the application of firing pulse to the valve (start of conduction). Also called delay angle.

firm power an amount of electric power intended to be available at all times to a commercial customer, regardless of system conditions.

firm real-time *See* firm real-time system.

firm real-time system a real-time system that

can fail to meet one or more deadlines without system failure. *Compare with* soft real-time, hard real-time.

firmware software that cannot be modified by the end user.

first-fit memory allocation a memory allocation algorithm used for variable-size units (e.g., segments). The "hole" selected is the first one that will fit the unit to be loaded. This hole is then broken up into two pieces: one for the process and one for the unused memory, except in the unlikely case of an exact fit, there is no unused memory.

first-in-first-out (FIFO) a queuing discipline whereby the entries in a queue are removed in the same order as that in which they joined the queue.

first-in-last-out (FILO) a queuing rule whereby the first entries are removed in the opposite order as that in which they joined the queue. This is typical of Stack structures and equivalent to last-in-first-out (LIFO).

first-swing stability criterion to determine transient stability by use of the swing equation. The rotor angle immediately following a severe disturbance usually increases. The criterion states that if the rotor angle swings back and decreases a short time after the disturbance, then the system is first-swing stable.

fissile material an isotope which has a significant probabilitty of undergoing nuclear fission, e.g., U235, plutonium-239, thorium-232, and enriched uranium.

fission the nuclear reaction in which a single heavy nucleus is split into two or more lighter nucleii called "daughter" products and emit highly energetic sub-atomic particles plus energy in the process.

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